

Figure 1

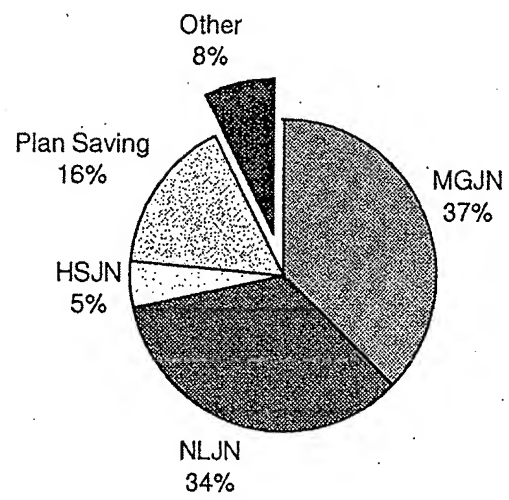
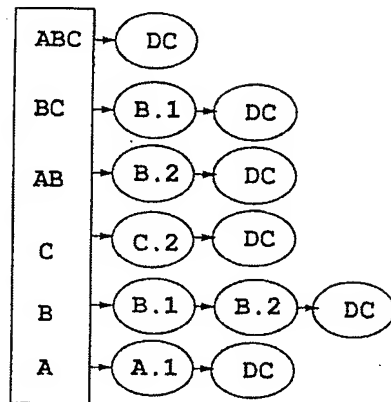


Figure 2

Both Queries Have 4 Joins
 (A, B) (B, C) (A, BC) (AB, C)

Select A.2
 From A, B, C
 Where A.1 = B.1
 and B.2 = C.2 ;

MEMO Structure

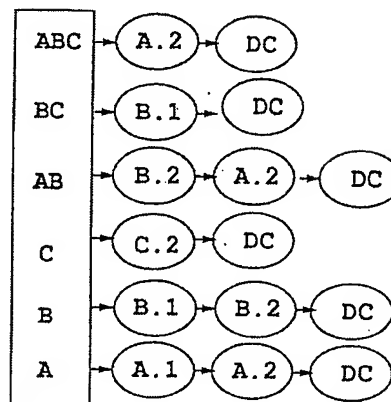


Number of Plans = 12

Figure 3a

Select A.2
 From A, B, C
 Where A.1 = B.1
 and B.2 = C.2
 Order By A.2 ;

MEMO Structure



Number of Plans = 15

Figure 3b

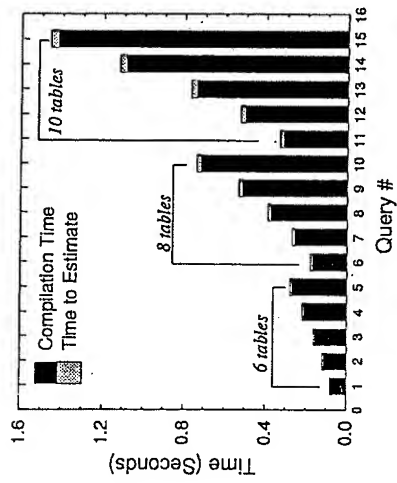
```

initialize(S)
input S: a MEMO entry
begin
  Allocate an interesting property list for S.
  If (S is for a single table)
    populate interesting property list for S based on
    the generation policy of  $P$ 
end

accumulate_plans(S, L, J)
input S,L: MEMO entries of two table sets to be joined
output J: MEMO entry of the joined table sets
begin
  define  $list_s$ ,  $list_l$  and  $list_j$  to be the interesting
  property list of S, L and J respectively
  For each property  $p$  in  $list_s$  and  $list_l$ 
    if ( $p$  can be propagated by at least one join method)
      if ( $p$  has not been retired by the join AND
         $p$  is not equivalent to any property in  $list_j$ )
        add  $p$  to  $list_j$ 
  For each join type  $t$ 
    accumulate join plans in  $join_t$ 
    if ( $t$  fully propagates  $P$ )
       $join_t+ = |list_s \cup list_l|$ 
       $join_t+ = 1$  (for  $DC$  property)
    if ( $t$  partially propagates  $P$ )
       $list_p = \{p | p \in list_s \cup list_l, t \text{ propagates } p\}$ 
       $list_c = \{p2 | p1 \prec p2, p1 \in list_p, p2 \in list_s \cup list_l\}$ 
      ( $list_c$  is the coverage list)
       $join_t+ = |list_p \cup list_c|$ 
    if ( $t$  doesn't propagates  $P$ )
       $join_t+ = 1$ 
end

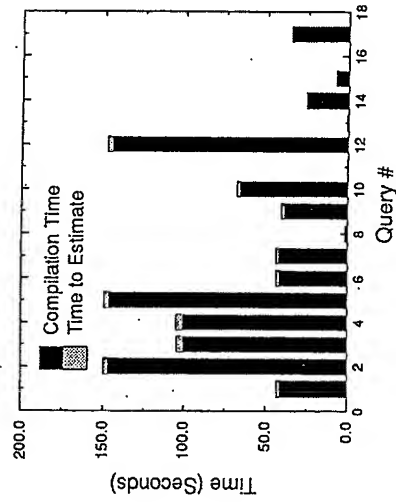
```

Figure 4



(a) *linear_s*

Figure 5a



(b) *real2_s*

Figure 5b

Actual Time	Time to Estimate	Pctg
17.010	0.115	0.7%
1.103	0.031	2.8%
4.353	0.022	0.5%
12.670	0.085	0.7%
1.771	0.0203	1.1%
11.161	0.038	0.3%
11.157	0.035	0.3%
1.350	0.0173	1.3%

(c) *real1_p*

Figure 5c

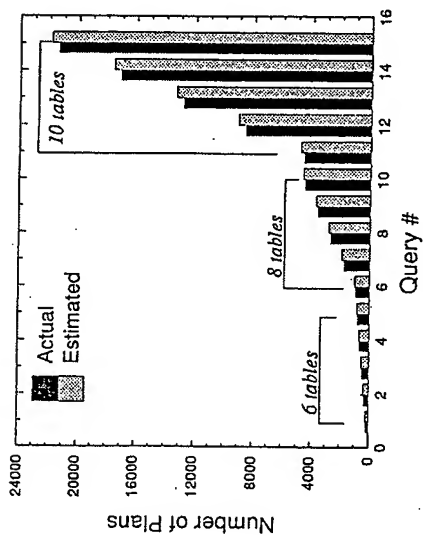


Figure 6a

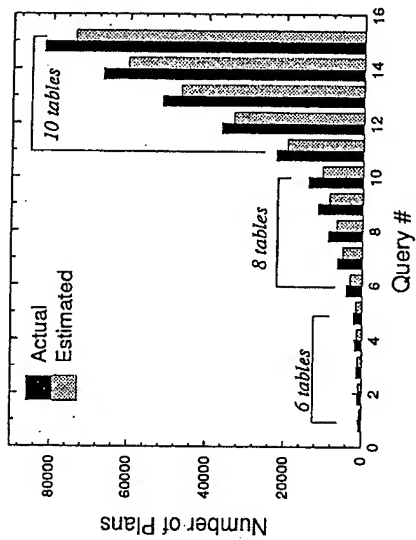


Figure 6b

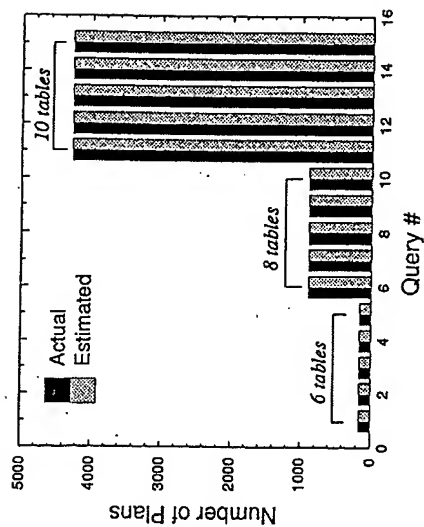


Figure 6c

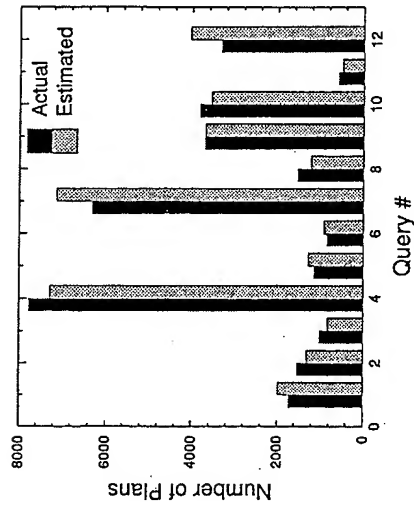


Figure 6d

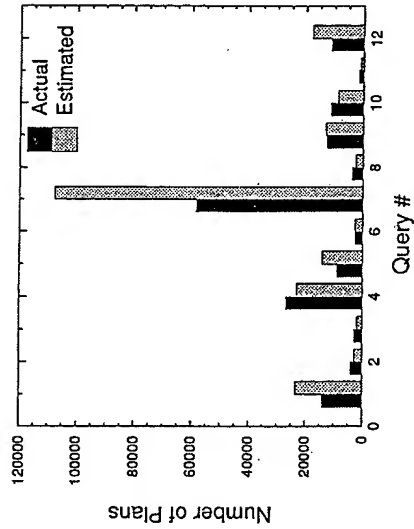


Figure 6e

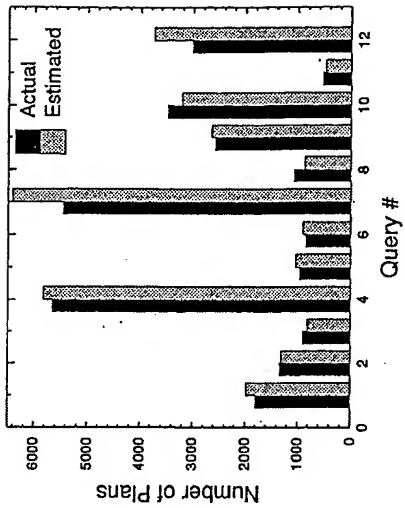


Figure 6f

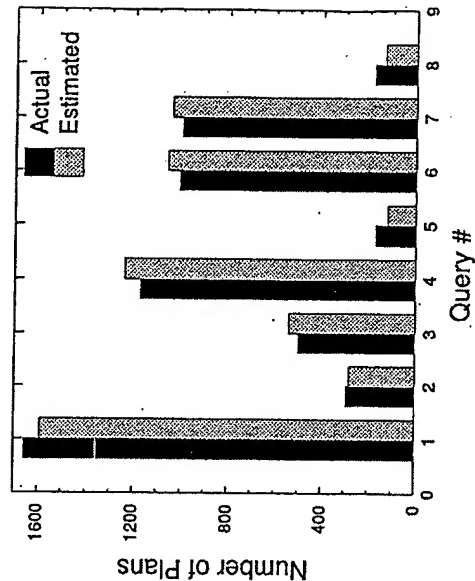


Figure 6i

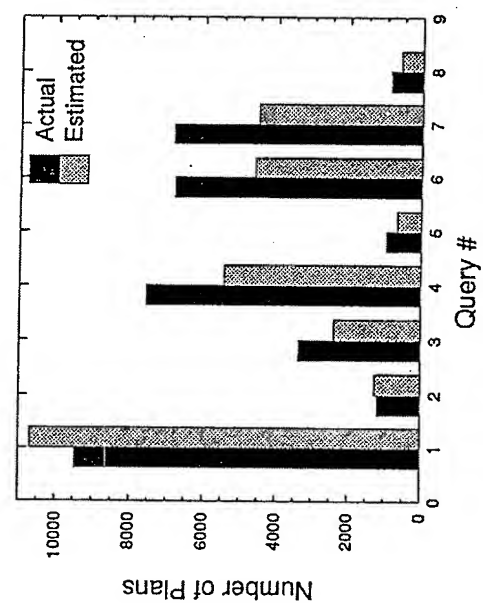


Figure 6h

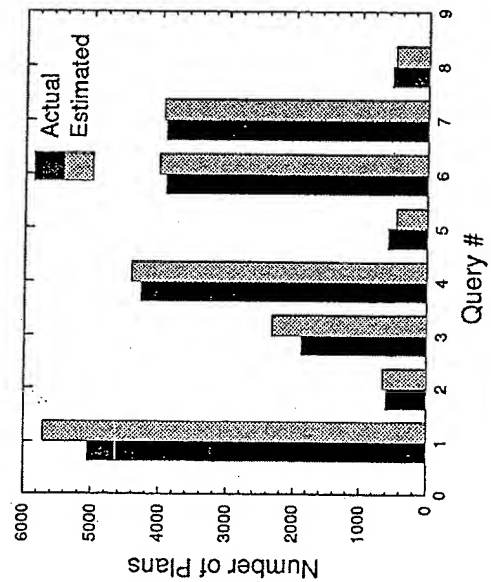


Figure 6g

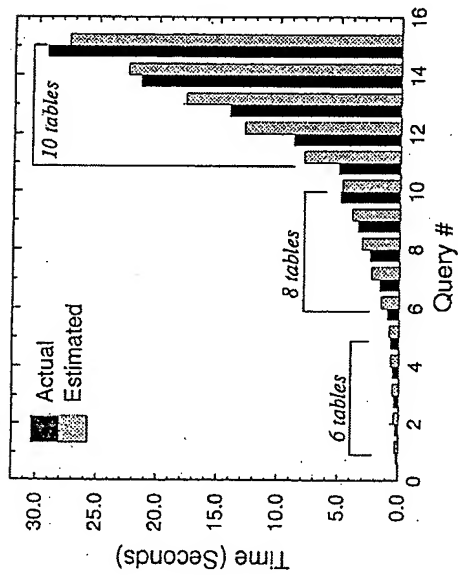


Figure 7a

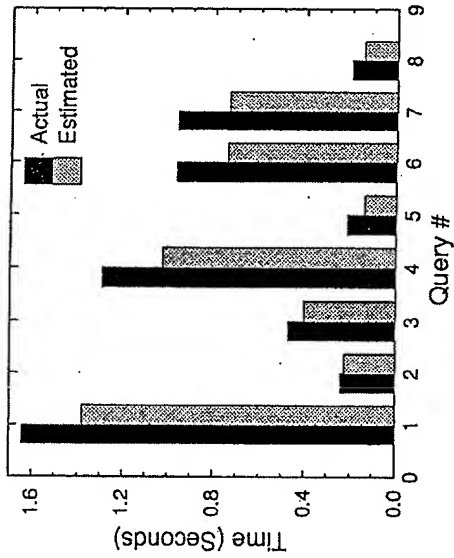


Figure 7b

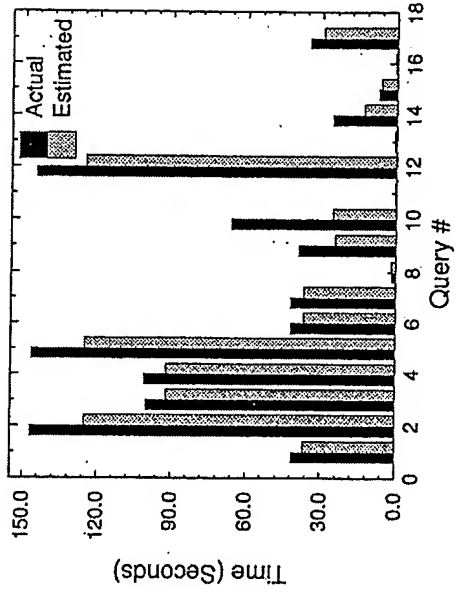


Figure 7c

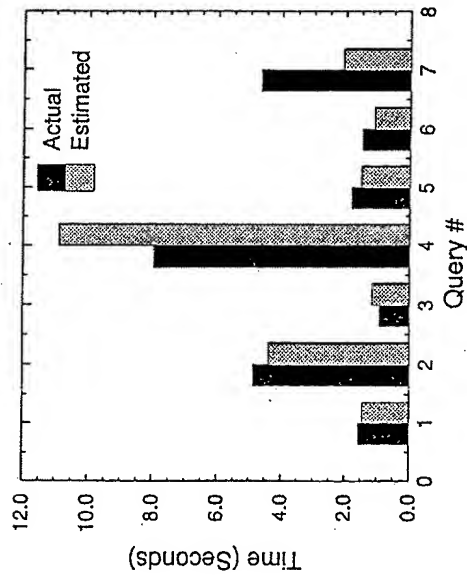


Figure 7d

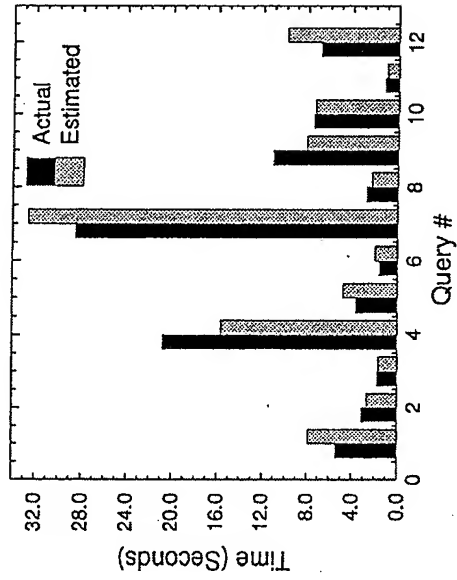


Figure 7e

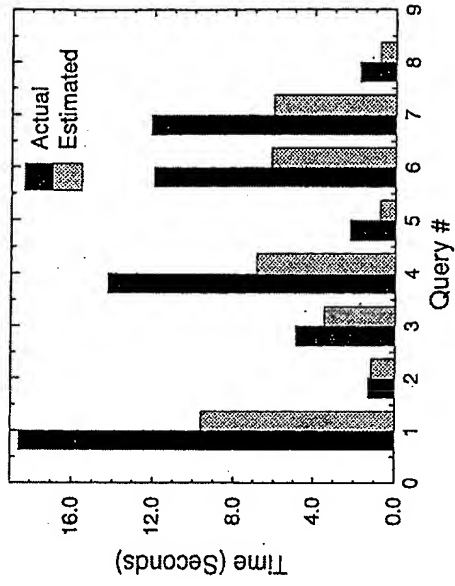


Figure 7f